TAD01 – (A3 Notes) Infrared (IR) Spectroscopy

Name …….

1. A.3.1 Describe the operating principles of a double-beam IR spectrometer. (2) *A schematic diagram of a simple double-beam spectrometer is sufficient.*
    a. What can IR radiation do to a molecule?

        i. What does the frequency of vibration depend on?

        ii. What are the two main uses of IR spectroscopy?

    b. An IR spectrometer measures the extent to which IR radiation is absorbed by a sample over a particular frequency range of IR radiation

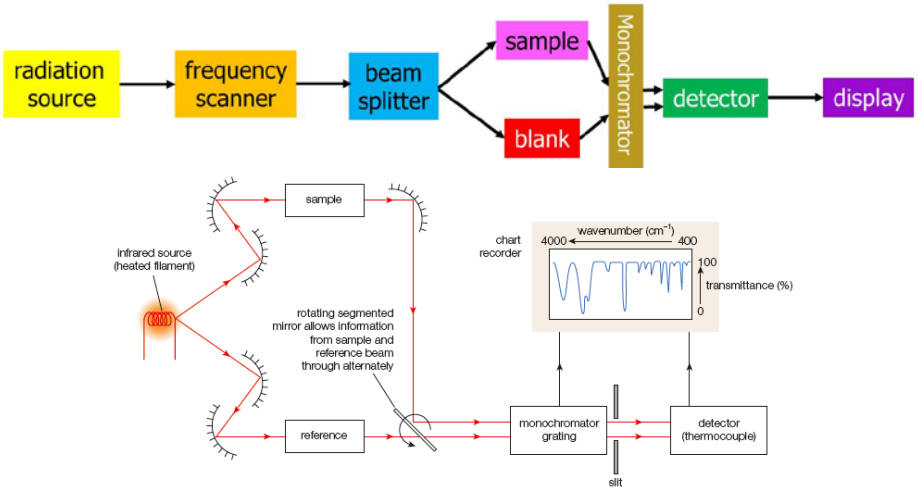


Figure 21.21 The essential optics and components of a double-beam infrared spectrometer

    i. Describe the use of each segment of the IR spec process:
        1. Radiation Source:

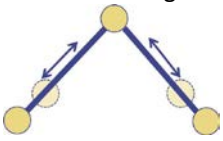
        2. Beam Splitter:

        3. Mirrors:

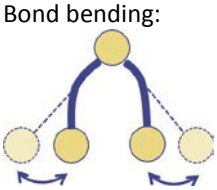
        4. Monochromator:

        5. Detector:

2. A.3.2 Describe how information from an IR spectrum can be used to identify bonds. (2)
    a. The IB data booklet contains lit values for the vibrations of individual bonds.
3. A.3.3 Explain what occurs at a molecular level during the absorption of IR radiation by molecules. (3) *H2O, –CH2–, SO2 and CO2 are suitable examples. Stress the change in bond polarity as the vibrations (stretching and bending) occur.*
    a. Two types of IR excitation can occur within molecules:
        i. Bond Stretching:

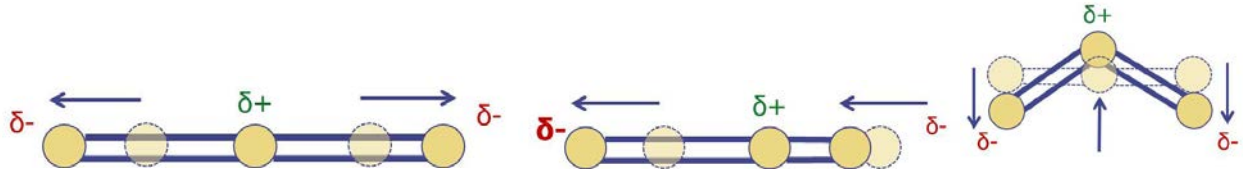


        ii. Bond bending:

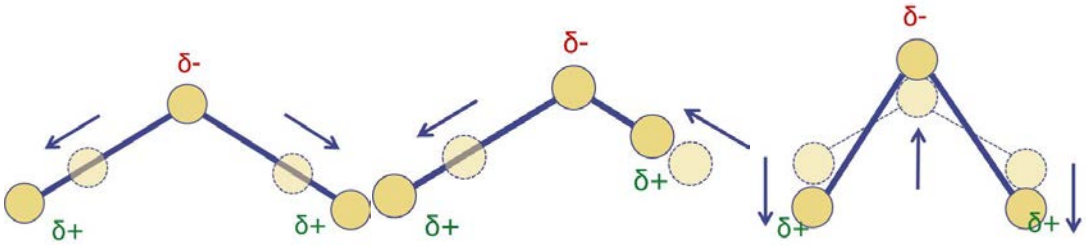


b. What molecules are able to be see with IR?

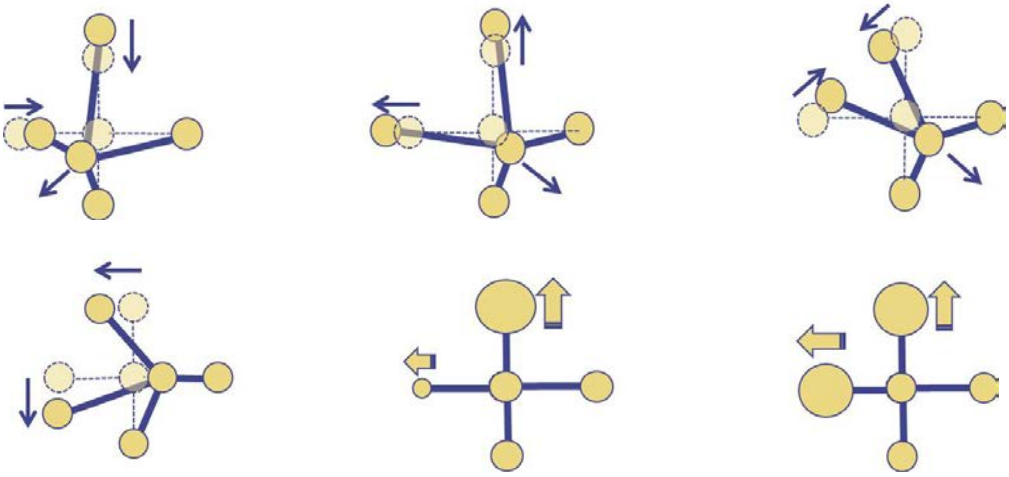
c. Discuss the activity of CO_2 excitation:



d. Discuss the activity of H_2O excitation:



e. Discuss the activity of CH_4



4. A.3.4 Analyse IR spectra of organic compounds. (3) *Students will be assessed using examples containing up to three functional groups. The Chemistry data booklet contains a table of IR absorptions for some bonds in organic molecules. Students should realize that IR absorption data can be used to identify the bonds present, but not always the functional groups present.*